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S.Z. BERRY, K. WIESE, A.D. BISGES, M.R. UDDIN, M. BENNETT & C.C. WILLER

Department of Horticulture
The Ohio State University
Ohio Agricultural Research & Development Center
Wooster, OH 44691

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INTRODUCTION

Tomatoes continue to be the most important processed crop in Ohio with a harvested acreage in 1987 of about 16,000 acres, and 350,000 ton production; yield per acre was significantly less than 1986 at about 22 tons/acre with a range of yield per acre between 12 to 40 tons per acre. Harvest in Ohio started in the central area of the state the latter part of July. Although processing tomato production is concentrated in the northwest area of the state, areas are being developed in south-central Ohio. Harvest in the main northwest production area of the state began in early August and was almost complete by the end of September. Excess moisture from heavy rainstorms caused some water damage earlier in the season. Heavy rains in late-August slowed harvest activity and caused some mold, disease, and fruit cracking losses. Otherwise relatively good growing conditions prevailed. New planting practices, growing methods, machine harvest-bulk handling and new processing technology require a continuous supply of better suited varieties in order that the industry remain competitive. Ohio continues to be the second largest processing tomato production state in the United States.

This breeding work continues to be directed with emphasis on improvement of the whole-canned tomato (whole-pack) and tomato suitable for diced product. Other needs of the canner are also being given attention in relation to development of improved varieties for the processor of various juice, sauce and paste products.

Selection for earliness and improved fruit setting ability, especially during periods of heat stress, is being carried out to reduce the problem of split fruit set and make possible more uniform tomato harvest schedules. With increased direct seeding, greater emphasis is being given to seed germination cold tolerance. Other important characteristics being selected to make machine harvest and bulk handling more efficient include crack resistance; firmness and ability of ripe fruit to store well on the vine for extended periods to allow maximum usable ripe fruit recovery in once-over harvest. Thus, in addition to increased productivity, a major objective is more effective utilization of yield already being attained, especially in regard to factors minimizing loss due to green, overripe and decayed fruit. Jointless pedicel (j2) is being utilized to facilitate machine harvest and allow harvest of fruit free of stems.

Professor, Assistant Professor, Research Assistant, Post-Doctoral Research Associate, Assistant Professor & Branch Manager

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Improved quality factors being selected for and intensively evaluated for in cooperation with commercial processors include: acidity, pH, soluble solids, viscosity, color (crimson fruit color [og^c], vitamin C, and especially fruit attributes conditioning efficient lye or steam peeling characteristics, coreless-ness and high case yield.

For the 1987 season, Ohio 7870 continued to be used as an early-main season Verticillium-Fusarium resistant, machine harvest cultivar. It continued to exhibit excellent productivity and especially good fruit disease resistance and holding ability. Commercial yields of Ohio 7870 were excellent where harvested by hand as well as by machine. It exhibited good adaptability for the production of whole-canned coreless and diced product, as well as for pureed product.

Ohio 7814 acreage increased in 1987 and it is proving to be a valuable asset as an early-main season Fusarium resistant, jointless pedicel, machine harvest type with excellent firmness, holding ability and resistance to fruit rots. It is is especially suited for coreless wholepack and diced pack, as well as pureed products. It has continued to compare well with the standard varieties and has been superior in quality for wholepack. Yields and quality through the Midwest and Canada were excellent and acreage of Ohio 7814 will increase in 1988.

Acreage also increased of recently released Ohio 832. It is main-season, early, Verticillium-Fusarium resistant with excellent productivity. Fruit have the crimson color characteristic, are uniform ripening, crack resistant and represent an improvement in color and raw product recovery quality characteristics over that of Ohio 7870. It is being utilized for juice, sauce, catsup, diced product and continues to exhibit improved processing color, solids and viscosity. Commercial acreage being grown of Ohio 832 is extensive through the Midwest and Canada.

The Ohio 7983 has been extensively evaluated and is very promising as an early, high quality machine harvest, jointless pedicel, whole-pack type. Commercial seed is available for trial.

Ohio 8243 is a very productive early main-season, jointless pedicel, machine harvest line with Fusarium wilt resistance. It is suitable for coreless wholepack, as well as diced and processed product. Ohio 8243 has shown good performance in commercial trials and especially on lighter soils. It compares well with standard varieties and has been superior in most quality aspects for wholepack as well as processed product. Commercial seed is available.

Ohio 8245 is a productive main season, jointless pedicel, machine harvest line with Fusarium and Verticillium wilt resistance. It has excellent quality aspects for coreless wholepack, diced product, as well as processed product. It is being extensively evaluated in commercial trial. Commercial seed is available.

Ohio 8442 and Ohio 8444 are Verticillium-Fusarium, Bacterial Speck resistant lines, which have exhibited good potential for product use with advantageous earliness and quality attributes. These lines are being extensively evaluated in commercial trial.

The use of hybrid processing tomatoes by the industry has increased. Hybrids have facilitated the utilization of desirable productivity and quality

characteristics and acreage planted to hybrids is increasing. Research to develop parental material with improved earliness, productivity, disease resistance and quality is continuing and such material is being utilized in newly formulated hybrids.

MATERIALS AND METHODS

Location: Vegetable Crops Branch, Fremont, Ohio.

Soil: Silty clay loam, spring bedded.

Fertilizer: 800 lb. per acre of 0-26-26, October; 210 lb. per acre of 34-0-0, April.

Herbicide: Sencor directed spray 0.5 lb. ai June, and again 0.5 lb. ai, July.

Plants: Greenhouse-grown, 108 per standard flat from seed sown April 9.

Transplanted to Field: May 26, a two-row transplanter using 21-53-0 starter at 5 lb. per 100 gal. of water; 1/2 pint per plant.

Plot Size and Spacing: One-row plots, 20 plants per row spaced 12 inches, rows 5 feet apart; Trial I, 3 replications; Trial II, non-replicated.

Insect and Disease Control: Standard recommended program followed for insect and disease control.

Weather Data (Fremont, Ohio)

	Temperature		Rainfall (inches)	
	1987	33 Yr. Avg.	1987	33 Yr. Avg.
April	49.4	48.4	1.76	3.08
May	63.3	59.0	2.69	3.47
June	70.6	68.2	5.44	3.97
July	74.4	72.4	4.87	4.04
August	69.6	70.1	4.35	3.52
September	64.7	64.2	1.12	2.90

HARVEST INFORMATION

Optimum weather conditions characterized the planting period. Growing season precipitation was normal, helping insure high average yields in the commercial crop. There, however, were periods of excessively hot, humid weather in July and August, which tended to stress the crop and accelerate fruit maturity. Areas of the Vegetable Branch trials experienced severe water damage on heavier soil areas earlier in the season with resultant adverse effects on the trial through the season to harvest. Harvesting was with a Johnson tomato harvester and was carried out when the entries were estimated to be at a stage of fruit ripeness in which yields of marketable fruit were approaching optimum recovery with a minimum of green and cull fruit (Tables 1 & 3). Percentages reported of fruit recovery are on a weight basis.

RESULTS

The data for the new experimental lines is organized according to maturity groups and within maturity by once-over machine-harvest fruit yield (Tables 1 & 3). Because of the complexity of factors which determine a potentially successful variety, other factors which must be considered and that can be limiting are included; eg., fruit concentration, fruit cull percentage, fruit size, stemming character, and jointlessness. It must be stressed that to adequately evaluate promising lines at least one or two more years of testing will be necessary.

QUALITY EVALUATION

Field-run tomatoes were used for quality evaluation; the sample was cut in half, quartered, extracted in a Food Processing Equipment Co. laboratory pulper, and de-aerated (Tables 2 & 4).

1. Agtron E-5. Instrument calibrated at 48.
2. Hunter Color Difference Meter (CDM).
3. Percent Soluble Solids: Abbe Refractometer
4. Percent Total Acid as citric: The raw sample used for pH determination was directly titrated using 0.1 normal sodium hydroxide solution to a pH of 8.1.
5. pH was determined by the glass electrode method.
6. Vitamin C (ascorbic acid) standard procedure:

$$\text{Dye Factor} \times \text{ml of dye} \times 100 = \frac{\text{mgs Vitamin C}}{\text{100 gms}}$$

Seed Sources and Cooperators

1. S.Z. Berry, Dept. of Horticulture, OSU-OARDC, Wooster, OH.
2. F. Cortelyou, Hunt-Wesson Foods, Inc., Perrysburg, OH.
3. D. Ematty, H.J. Heinz Co., 13737 Middleton Pike, Bowling Green, OH
4. C. Nichols, Ferry-Morse Seed Co., San Juan Bautista, CA.
5. W. Springer, ADI Distributors, Inc., Carmel, IN.
6. W.S. Taylor, Campbell Soup Co., CIRT, Napoleon, OH.

TABLE 1. Trial I. Field evaluation of processing tomato varieties and test lines for mechanical harvest when yields of marketable fruit were approaching optimum recovery. Vegetable Crops Branch, OARDC, Fremont, Ohio 1987.

Variety or Test Line	Ripe Usable Tons/A	Ripe Usable % of Potential	% of Potential Cull	Fruit Size (oz)	Stems %	Stems (j2-jointless) (+-jointed)
Harvest Date 8/12/87						
Heinz 2653	16.5	69	20.9	2.3	1	j2
Heinz 7135-H	11.6	79	5.7	2.3	62	+
Harvest Date 8/17/87						
Ohio 8432	20.2	66	12.0	2.8	2	j2
Ohio 8383	19.7	70	12.0	2.8	0	j2
FM 6203	19.5	63	8.1	2.7	6	+
Ohio 7983	19.0	72	7.7	2.0	0	j2
Malinta	17.2	62	9.8	2.8	1	j2
Ohio 8655	16.7	64	17.0	3.1	10	+
Ohio 8550	15.3	56	6.0	2.4	0	j2
Ohio 7814	14.9	65	6.9	2.0	0	j2
Ohio 8442	14.2	57	22.5	1.8	1	j2
Harvest Date 9/2/87						
Ohio 8245	26.5	70	11.2	2.3	1	j2
Maumee	25.1	57	36.2	3.2	0	j2
Ohio 8243	23.2	69	13.8	1.9	0	j2
Ohio 8675	21.9	59	17.5	2.2	0	j2
Ohio 8556	21.4	58	29.7	2.4	0	j2
Ohio 7870	21.3	61	16.3	2.6	31	+
Ohio 8590	19.6	55	31.8	2.1	0	j2
Ohio 8239	19.4	56	30.8	2.1	0	j2
Ohio 8558	19.0	60	26.6	2.3	7	+
Ohio 8567	18.2	55	26.5	2.8	1	j2
Ohio 8374	17.4	52	36.8	2.2	0	j2
Ohio 832	17.2	55	27.4	2.9	0	j2
Ohio 8575	16.4	49	35.2	2.4	0	j2
Easy Winner	14.3	50	44.0	2.4	3	j2
Harvest Date 9/4/87						
Ohio 8449	22.7	67	21.2	2.5	21	+
Easy Harvest	22.4	65	22.9	2.5	3	j2
Heinz 722	20.9	58	14.7	2.1	0	j2
LSD 5%	6.3			0.3		

TABLE 2. Trial I. Laboratory evaluation of processing tomato varieties and test lines. Vegetable Crops Branch, OARDC, Fremont, Ohio, 1987.

Variety or Test Line	pH	% Citric acid	% Soluble solids	Color		
				Hunter CDM a/b	Agtron E5	Vit. C mg/100 gm
Heinz 2653	4.60	0.37	3.9	2.4	41	23.0
Heinz 7135-H	4.50	0.34	4.2	2.4	43	40.5
Ohio 8432	4.40	0.39	4.7	2.9	33	24.9
Ohio 8383	4.60	0.38	4.9	2.8	35	18.5
FM 6203	4.49	0.38	4.8	2.6	37	23.1
Ohio 7983	4.65	0.33	4.8	2.5	36	16.9
Malinta	4.53	0.34	4.8	2.4	37	21.6
Ohio 8655	4.65	0.26	4.7	2.9	36	18.4
Ohio 8550	4.75	0.28	4.4	2.6	39	15.4
Ohio 7814	4.45	0.44	4.5	2.6	41	32.2
Ohio 8442	4.70	0.26	4.4	2.1	42	18.5
Ohio 8245	4.43	0.41	4.3	2.8	36	18.7
Maumee	4.63	0.31	4.6	2.4	40	15.4
Ohio 8243	4.50	0.39	4.4	2.6	38	30.4
Ohio 8675	4.65	0.36	4.8	2.5	33	13.6
Ohio 8556	4.70	0.30	4.8	2.6	35	21.6
Ohio 7870	4.70	0.36	4.9	2.7	38	22.0
Ohio 8590	4.60	0.30	4.4	2.7	39	7.7
Ohio 8239	4.70	0.35	4.2	2.6	38	10.0
Ohio 8558	4.80	0.25	4.1	2.5	38	20.0
Ohio 8567	4.78	0.28	4.7	2.6	37	17.7
Ohio 8374	4.70	0.38	4.0	2.7	40	20.2
Ohio 832	4.60	0.38	4.5	3.0	36	22.5
Ohio 8575	4.70	0.29	4.1	2.7	39	18.4
Easy Winner	4.45	0.33	4.5	2.4	37	26.7
Ohio 8449	4.45	0.35	4.4	2.7	47	23.1
Easy Harvest	4.70	0.34	5.0	2.5	46	18.5
Heinz 722	4.45	0.44	4.6	2.5	42	22.1

TABLE 3. Trial II. Field evaluation of processing tomato varieties and test lines for mechanical harvest when yields of marketable fruit were approaching optimum recovery. Vegetable Crops Branch, OARDC, Fremont, Ohio 1987.

Variety or Test Line	Ripe Usable Tons/A	Ripe Usable % of Potential	% of Potential Cull	Fruit Size (oz)	Stems %	Stems (j2-jointless) (+-jointed)
Harvest Date 8/12/87						
Ohio 86135	23.0	64.5	16.5	2.6	10.0	+
Ohio 87610	16.5	54.3	6.4	1.9	0.0	j2
Harvest Date 8/19/87						
Ohio 87161	24.7	65.4	22.5	2.1	0.0	j2
Ohio 87167	23.7	71.2	17.6	2.2	0.0	j2
Ohio 87171	23.5	70.5	17.4	2.3	0.0	j2
Ohio 87184	21.5	75.3	9.9	1.9	0.0	j2
Ohio 87154	21.4	71.6	18.6	2.0	2.0	j2
Ohio 87162	18.6	55.9	26.1	1.6	0.0	j2
Ohio 86113	18.4	71.3	17.7	1.8	0.0	j2
Ohio 86112	18.4	56.9	30.7	2.7	0.0	j2
Ohio 87158	17.9	59.9	18.9	1.7	0.0	j2
Harvest Date 9/02/87						
Heinz 6315-H	39.3	75.1	16.2	2.7	4.0	j2
Ohio 86122	34.2	69.8	16.2	2.4	0.0	j2
Ohio 87152	30.0	62.2	26.7	2.4	2.0	j2
Ohio 87177	29.2	76.4	5.7	1.5	0.0	j2
Ohio 87145	28.2	52.7	23.4	2.8	6.0	+
Ohio 87148	28.1	58.5	14.3	2.4	2.0	j2
Ohio 7983	27.7	68.3	20.4	2.0	0.0	j2
Ohio 87185	27.4	69.0	22.8	1.8	0.0	j2
Ohio 8695	27.3	62.7	11.8	2.1	0.0	j2
Ohio 8690	27.0	64.5	22.4	2.2	0.0	j2
Ohio 87182	25.5	66.3	24.6	1.8	4.0	j2
Ohio 8693	25.4	59.5	14.5	2.4	0.0	j2
Heinz 7145-H	24.9	61.0	32.9	2.3	0.0	j2
Ohio 8687	23.4	54.3	30.6	2.0	0.0	j2
Ohio 8689	23.1	54.8	22.0	2.3	0.0	j2
Ohio 87173	21.4	54.1	14.3	2.0	0.0	j2
Ohio 87174	21.1	63.0	26.0	2.1	0.0	j2
Ohio 8673	20.8	54.9	12.9	2.0	2.0	j2
Ohio 832	19.2	57.4	26.7	2.5	24.0	+
Ohio 87190	16.4	47.6	10.1	1.7	0.0	j2

TABLE 4. Trial II. Laboratory evaluation of processing tomato varieties and test lines. Vegetable Crops Branch, OARDC, Fremont, Ohio, 1987.

Variety or Test Line	pH	% Citric acid	% Soluble solids	Color		Vit. C mg/ 100/g
				Hunter CDM a/b	Agtron E5	
Ohio 86135	4.50	0.26	3.6	2.4	35	18.4
Ohio 87160	4.60	0.25	3.7	2.2	36	27.2
Ohio 87161	4.60	0.24	3.9	2.2	37	22.4
Ohio 87167	4.58	0.26	4.5	2.4	34	22.4
Ohio 87171	4.55	0.29	5.6	2.3	35	22.4
Ohio 87184	4.49	0.30	4.4	2.3	35	23.2
Ohio 87154	4.55	0.27	3.6	2.6	34	16.0
Ohio 87162	4.39	0.31	3.7	2.4	35	24.8
Ohio 86113	5.12	0.32	5.1	2.4	36	23.2
Ohio 86112	4.50	0.33	4.5	2.6	32	25.0
Ohio 87158	4.50	0.27	3.5	2.5	31	26.4
Heinz 6315-H	4.40	0.28	4.8	2.4	34	29.6
Ohio 86122	4.70	0.31	5.5	2.7	36	20.8
Ohio 87152	4.40	0.28	3.7	2.6	34	25.6
Ohio 88177	4.45	0.35	4.6	2.5	33	25.6
Ohio 87145	4.70	0.27	4.8	2.4	32	22.4
Ohio 7983	4.70	0.32	4.7	2.5	37	26.4
Ohio 87185	4.55	0.27	4.5	2.2	36	17.6
Ohio 8695	4.70	0.28	4.7	2.4	33	20.0
Ohio 8690	4.98	0.22	4.4	2.3	34	19.2
Ohio 87182	4.61	0.32	5.3	2.5	35	24.0
Ohio 8693	4.60	0.31	4.5	2.4	34	14.4
Heinz 7145-H	4.50	0.27	4.6	2.6	34	25.6
Ohio 8687	4.81	0.24	4.6	2.5	34	21.6
Ohio 8689	4.90	0.24	5.0	2.5	32	17.6
Ohio 87173	4.51	0.39	5.1	2.7	32	23.2
Ohio 87174	4.80	0.27	4.7	2.3	35	13.6
Ohio 8673	4.80	0.27	4.7	2.3	35	13.6
Ohio 832	4.78	0.30	4.3	2.7	32	16.8
Ohio 87190	4.41	0.31	4.5	2.4	34	21.6

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